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Ethnic differences in risk factors for adverse birth outcomes between Pakistani, Bangladeshi and White British mothers

Abstract

Aim

Reducing poor maternal and infant outcomes in pregnancy is the aim of maternity care. Adverse health behaviours lead to increased risk and can adversely mediate birth outcomes. This study examines whether risk factors are similar, different or clustered according to maternal ethnicity.

Design

Retrospective analysis of routinely collected data (2008-2013)

Methods

We analysed data routinely collected data from a local University Hospital Ciconia Maternity information System (CMiS), for White British, Pakistani and Bangladeshi women (N=15,211) using cross-tabulations, ANCOVA, adjusted standardised residuals (ASR) and Pearson Chi-square statistics.

Results

The results demonstrate distinct clusters of risk factors between White British, Pakistani and Bangladeshi mothers'. Additionally, Pakistani mothers had the highest number of statistically significant risk factors, according to maternal ethnicity, including showing that 49% of women in this cohort that were diagnosed with diabetes were Pakistani, 21.5% of White British women smoked and results showed that Bangladeshi mothers delivered the lightest weight infants (adjusted mean 3055.4g).

Conclusions

This study found differences in the risk factors between White British, Pakistani and Bangladeshi mothers. The identified risk factors were clustered by maternal ethnicity.

Impact

Identification of these risk factor clusters can help policy makers and clinicians direct resources and may help reduce ethnic variation found in these populations that might be attributed to adverse health behaviours and increased risk factors.

Key words: White British, Pakistani, Bangladeshi, maternity, health behaviour, risk factors, nursing.

Introduction

Early identification and the reduction of modifiable risks associated with adverse health behaviour during pregnancy is the essence of antenatal care, which aims to prevent poor birth outcomes, such as stillbirth, low birthweight and pre-term delivery (National Institute for Health and Care Excellence, 2012). Antenatal care itself is a complex intervention, incorporating early risk assessment and pertains to various maternal health behaviours (The National Institute for Health and Care Excellence, 2010). It is widely accepted that particular modifiable risk factors have been associated with poor birth outcomes. For example, studies have demonstrated mediated maternal or fetal outcomes in the following health behaviour: tobacco consumption (Leonardi-Bee, Smyth, Britton, & Coleman, 2008)nutritional status (e.g. folic acid and vitamin D) (Ed, Fredericks, & Weston, 2010), monitoring fetal movement (O'Sullivan, Stephen, Martindale, & Heazell, 2009), attendance in maternity services after 12th week of gestation (referred to as late booking)(Cresswell et al., 2013), maternal obesity (Jacob, Kostev, & Kalder, 2015), gestational (GDM) (Rosenberg, Garbers, Lipkind, & Chiasson, 2005) or pre-existing diabetes (Cundy et al., 2000).

Background

There is growing interest in research and interventions on health beliefs and health behaviours, understanding that health beliefs are considered modifiable as they demonstrate plasticity (Conner, 2013; Ogden, 2007). While there is a paucity of research that focuses on maternal health beliefs (Lucas, Murray, & Kinra, 2013), there is a wealth of published research on maternal risk factors, however, these are typically conceptualised in the perspective of single behaviours or risk factors on a particular birth outcome. Consequently the wider social and environmental context is excluded from these studies (Noar, Chabot, & Zimmerman, 2008). Several psychological and social influences have been identified to mediate health beliefs, such as emotion, symptoms, perception and understanding of risk, social norms, self-efficacy, religion, culture, social learning (through early parenting), deprivation, physical proximity to health care services, maternal education and health literacy (Abraham & Michie, 2008; Degni, Suominen, Essén, El Ansari, & Vehviläinen-Julkunen, 2012). Moreover, the influence of religion fails to feature in most Western research despite being significant in shaping behaviour (Gunderson & Cochrane, 2012) and, while health behaviours do involve personal choice, research tends to focus on individuals and does not consider wider environmental factors, thus creating a blame approach (Jarvis & Wardle, 2006). This further obscures why some health behaviours or risk factors may be more prevalent in particular socioeconomic groups, than others (Jarvis & Wardle, 2006). Significantly, an often overlooked limitation of health behaviour research in maternity settings, is the dominant focus of essentialised and homogenised women, typcally excluding minority women's health behaviour and as such, it is unclear whether health behaviour resulting in higher risk factors are salient to all women or unique to certain ethnic groups.

Few studies have considered how maternal risk factors may cluster, mediating potential risk for poor birth outcomes and address whether similar or diverse patterns may be evident between mothers of different ethnic groups (Buck & Frosini, 2012). Recently a few studies have been published which do detail difference between Pakistani and White British women (Bansal, Chalmers, Fischbacher, Steiner, & Bhopal, 2014; West et al., 2014), only one study reports the outcomes including a very small sample of Bangladeshi mothers (Petherick et al., 2016).

These studies examine the geographic areas of Bradford and Scotland. Conversely, the present study focuses on Luton, England. Luton is a plural town with a diverse ethnic population, most are of south Asian ethnicity and is ranked as deprived (59th out of 326 areas in England, 1 being the most deprived) (Public Health England, 2015). Consequently, focusing attention in Luton adds a different perspective to the existing published research. This study examines whether health behaviours and risk factors during pregnancy are similar, different or clustered according to maternal ethnicity. Moreover, this study includes data from Bangladeshi mothers, who are typically an underresearched group, in United Kingdom (UK) maternity contexts, which contributes futher to our understanding of health behaviours and risk factors in pregnancy in these populations.

Aim

The aim of this study determines whether health behaviours and risk factors during pregnancy are similar, different or clustered according to maternal ethnicity; Pakistani, Bangladeshi or White British.

Design

Retrospective routinely collected data from *Ciconia Maternity information System* (CMiS) from NHS University Hospital Trust was analysed. CMiS is a clinical information system used in numerous maternity units in the UK. This study forms part of a wider mixed-method study, the results of which are published elsewhere (Garcia, 2017; Garcia et al, 2017a; Garcia et al, 2017b) or currently in review. Due to disproportionate rates of infant deaths in Luton to Pakistani and Bangladeshi families, these ethnic groups were selected for analysis and White British were included to further contrast results, if discernible.

Participants

A cohort of Pakistani (N= 5143), Bangladeshi women (N= 2057) and White British (N=7020) (N=15,211) were identified using the following inclusion and exclusion criteria;

Inclusion and exclusion criteria

Inclusion criteria: aged > 16 years old, all birth outcomes (i.e. live and perinatal mortality), delivery between January 2008 and December 2013, residing in a predefined postcode areas.

Exclusion criteria: Women < 16 years old, delivery outside range of January 2008 and December 2013 and not living within the predefined postcode areas.

Health behaviours and risk factors

Health behaviours and risk factors were identified following review of the current evidence and those identified factors (as potential variables) that were available in CMiS were used. Subsequently, the identified variables were; smoking status (at booking), gestation age at booking, parity, BMI (at booking), diabetes, maternal age, birthweight, maternal height and weight.

Ethnic classification

The CMiS data uses self-defined ethnic categories, coded according to the 2001 census codes and as used in the NHS mandatory set (Department of Health, 2008). Ethnicity is self-defined, incorporating culture, religion, shared language and ancestry (Economic and Social Data Service, 2012). Data on mothers place-of-birth, or residency was not available in the CMiS data. Consequently, maternal country of birth, generational status and length of residency are unaccounted in this paper.

Ethical considerations

Raw data were de-identified prior to release by the Caldecott guardian of the hospital. Other ethic approvals were sought and detailed at the end of this paper.

Data analysis

All statistical analyses performed used IBM Statistics Package for the Social Sciences (SPSS) ® v21. Frequency counts, percentages, cross-tabulations, ANCOVA, adjusted standardised residuals (ASR) and Pearson Chi-square were calculated to determine whether there were significant associations between maternal ethnicities (Pakistani, Bangladeshi and White British) and the outcome variables. The nature of the raw data output and re-coded variables restricted inferential statistics to ANCOVA and Pearson Chi-square, due to violations of homogeneity, unequal sample sizes and failing to meet the criterion of a normal distribution. This is a consequence of using secondary data; the original data were purposed in a clinical reporting system and not initially collected with the subsequent intention to apply inferential statistical analysis (Boslaugh, 2007).

Most raw data were categorical, therefore it was necessary to transform several variables: maternal BMI (<18.5, 19-24.9, 25-29.9, 30-39.9, 40-60)(N= 15 203), gestation age at delivery (24-$36^{6\ \text{days}}$, >37 weeks of gestation), smoking status (binary variable; yes/no), booking (0-12 weeks of gestation [early] and 12^{+1} weeks of gestation[late]) and diabetes was coded as a binary variable (yes/no), in addition to using the separate diabetes codes (i.e. gestational, on insulin, non-diabetic and pre-existing diabetes) in the data-set. This permitted analysis to be conducted, allowing for minimum frequency counts in each variable. Maternal age, was coded by the hospital prior to release to satisfy data protection and was provided in the following age-ranges (< 20; 21-25; 26-30; 31-35; 36-40; > 41).

Missing data were checked using the MCAR or MNAR test (Little, 1988), which was found to be significant, suggestive that some data were systematically missing. Presently there is no agreed method for dealing with non-random missing data (Baguley, 2012). Moreover, existing methods (e.g. multiple imputation or insertion of median figures) also have limitations and may contribute to bias and skewed results (De Goeij et al., 2013; Osborne, 2013) therefore complete-case analysis was considered the most appropriate method of dealing with missing data in this dataset.

Approval was provided by the hospital R&D department and the requested raw data were assessed and edited by the Hospitals Information Governance Manager to ensure adherence to patient confidentiality and data protection, prior to release to the research team. Ethic approval for the wider study was provided by the University of Bedfordshire Research Ethics Committee (March 2014).

Validity, reliability and rigour

The secondary data used in this study covered a period of 6 years (2008-2013) and as such used a large sample size (N= 15,211). However, it is recognised that the raw data used in this study was reliant on accuracy of data input into the computerised database by clinical staff and the database is a clinical recording system, not designed to collect pre-defined variables (Sarensen, Sabroe, & Olsen, 1996). It was also evident from analysis of the MNAR data that some variables were systematically missing (i.e. blood pressure and maternal height and/or weight). See data analysis section (Little, 1988).

Results

The characteristics of the sample are shown in table 1. There was a total of N=5130 (36.2%) Pakistani mothers, N=2053 (14.5%) Bangladeshi mothers and N=7005 (49.4%) White British mothers aged over 16 years in this cohort. The mean for gestational age at delivery (>37 weeks) for the cohort was 39.39 weeks and infant birthweight (>37 weeks) for the cohort was 3314.15 grams. Table 2 details the mean birthweight and confidence interval stratified by maternal ethnicity.

Maternal height and weight ranged from 155.1cm (White British) to 150.89cm (Bangladeshi) and 70.33kg (White British) to 60.26kg (Bangladeshi). Frequency counts and percentages for the categorical variables (i.e. maternal age, smokers, diabetic, maternal BMI at booking and gestational age at delivery) were calculated in SPSS (Table 1). The results show distinct patterning. For instance, out of the 11.9% of women that were recorded as being smokers (at their booking appointment), 94.3% of these were white British. Furthermore, the data showed that 7.3% of White British mothers delivered preterm (24-37 weeks of gestation), compared with 6.5% of Pakistani and 6.6% of Bangladeshi mothers. Additionally, White British women were found to have higher percentages of younger (16-20 years) 14.4% of women and older (over 40 years) 1.4% of women compared with Pakistani (4.3%, 0.8% respectively) and Bangladeshi women (4.5%, 0.4% respectively). Interestingly, the results found 49% of mothers who were diagnosed with gestational diabetes in this cohort, were Pakistani, whereas both White British and Bangladeshi mothers had similar percentages (22.6% and 28.5% respectively). While 2.1% of this women in this cohort were found to have a BMI >40kg/m^{2}, the analysis shows that 63.9% of these were White British, compared with 27.6% of Pakistani mothers and 8.5% of Bangladeshi mothers.

Smoking: The results showed that 21.5% of White British mothers were smokers (at booking), compared with 1.4% of Pakistani and 0.9% of Bangladeshi mothers. ASR revealed significant areas of over/under-representation, showing White British mothers are over-represented (ASR = 38.2), while Pakistani and Bangladeshi mothers are under-represented (ASR = -27.9 and ASR = -16.1, respectively). Pearson Chi-Square test tested independence between the categories and was significant (χ^2=1457.98, *df*=2, *p*<.005), indicative that smoking is significantly associated with maternal ethnicity.

Booking appointment: 82.1% of mothers were booked by 12 weeks of gestation. Pearson Chi-Square was significant ($\chi 2$=51.62, *df*=2, p<.005), suggestive that booking is significantly associated with maternal ethnicity. ASR was conducted to reveal significant areas of over/ under-representation, revealing White British mothers are over-represented in the early booking category (ASR = 7.2). Conversely, Pakistani and Bangladeshi mothers were under-represented in the early booking category (ASR = -5.6 & ASR = -2.6).

Parity: Cross-tabulation assessed parity distributions demonstrating 59.4% of White British mothers were parity 1, compared with 33.6% of Pakistani and 14.3% of Bangladeshi mothers. Pearson Chi-Square tested independence between the categories, with significant result ($\chi 2$=352.47, *df*=18, p<.005), indicating parity associated with maternal ethnicity.

BMI: White British women have highest mean BMI (21.84kg/m^2, standard deviation 11.12), Pakistani mothers BMI was in-between the White British and Bangladeshi mothers (20.21kg/m^2, standard deviation 11.7) and Bangladeshi mothers had the lightest mean BMI (20.26kg/m^2, standard deviation 10.85). Pakistani mothers had the greatest percentage of mothers with a BMI <18kg/m^2 (25.2%), 37.1% of Bangladeshi mothers were 19-24.5kg/ m^2 and 26.9% were 25-29.9kg/m^2 , whereas 16.7% of White British mothers were 30-39.9kg/ m^2 and 2.7% of White British women had a BMI of 40-60kg/ m^2 . Pearson Chi-Square test of association tested independence between the ethnic categories and was significant ($\chi 2$=126.32, *df*=8, p<.005). A more detailed analysis of BMI data from this cohort, whereby BMI measurements were applied to WHO standard BMI metrics and WHO Asian metrics showing differences between identified risk categories and has already been published (Garcia et al., 2017a).

Diabetes: Cross-tabulation was performed to determine associations between ethnicity and diagnosis of diabetes (i.e. diabetes, gestational, on insulin, not diabetic). Pearson Chi-Square tested independence between the categories. The result was highly significant ($\chi 2$=103.94, df=10, p<.005) and suggests strongly that diabetes diagnosis is significantly associated with maternal ethnicity. ASR estimated each ethnic group in the Chi-Square analysis to reveal significant areas of over/under-representation, showing that Pakistani mothers are over-represented in the diabetes category (ASR= 2.3) and GDM (ASR = 3.2) and Bangladeshi mothers are over-represented in the GDM category (ASR =5.0) and insulin category (ASR = 2.5), conversely, White British women were under-represented in the GDM category (ASR = -5.4).

The diabetes variable was re-coded into a binary variable (diabetic or non-diabetic). Cross-tabulation was repeated, testing any associations between ethnicity and diagnosis of diabetes. A Pearson Chi-Square tested independence between the categories and was highly significant ($\chi 2$=79.5, df=2, p<.005). ASR determined over/under-representation, revealing Pakistani mothers (ASR= 3.3) and Bangladeshi mothers (ASR =5.7) are over-represented in the diagnosed with diabetes category. Percentages show that 49% of diabetic mothers were Pakistani.

Maternal age: Frequency and percentages showed that 14.4% of White British women were aged 16–20, whereas 36.7% of Pakistani women were aged 26–30 and 8.8% of White British were aged 36–40. Pearson Chi-Square was significant (χ^2=528.92, df=10, p<.005), suggesting associations between parity and maternal age. ASR showed areas of over/under-representation, showing that White British were over-represented in ages 16–20 (ASR = 14.4) and 36–40 (ASR = 8.8), whereas Pakistani mothers were over-represented in ages 21–25 (ASR = 4.6) and 26–30 (ASR = 6.3) and Bangladeshi mothers were under-represented in ages 16–20 (ASR = -8.1), 36–40 (ASR= -3.5) and over 40 (ASR=-2.9).

Birthweight: These results are reported in detail elsewhere (Garcia, et al, 2017b). The dataset was filtered for singleton births. ANCOVA was used to determine effects of ethnicity on birthweight and adjust for confounders (i.e. maternal age, smoking status, diabetes, gestation age at delivery, parity and maternal height and BMI). Bangladeshi mothers had the lightest mean adjusted birthweights (3055.4g) compared with White British mothers who delivered infants with a mean adjusted birthweight of 3269.04g, showing a difference of 263.64g. This was significant; $F(2, 4440) = 112.8$, $p<.0005$. The partial Eta-squared for maternal ethnicity was $\eta^2 = .047$.

The covariates of BMI; $F(1, 4542) = 33.79$, $p<.005$, partial $\eta^2 = .006$), maternal smoking; $F(1, 4542) = 65.6$, $p<.005$ partial $\eta^2 = .014$), maternal height; ($F(1, 4542) = 4.34$, $p=0.037$ partial $\eta^2 = .001$), diabetes; $F(1, 4542) = 8.33$, $p=.004$, $\eta^2 = .003$), parity; $F(1, 4542) = 43.99$, $p<.005$, partial $\eta^2 = .003$) and gestation age at delivery; $F(1, 4542) = 3034.77$, $p<.005$, partial $\eta^2 = .003$), all had a significant effect on birthweight. Bonferroni posthoc analysis showed mean adjusted birthweight was significantly lower in Pakistani infants (mean difference of -161.508g, 95% CI [-196.96—126.05] *p<.00) and* Bangladeshi infants (mean difference of –197.89, 95% CI [-148.26- -247.53] *p<.005).*

Variables combined: When inspecting the assumptions for the Loglinear analysis, the output for cell counts and residuals showed that counts were <5 as a consequence of too many sub-groups when using all the variables in one model. Reconfiguring the model, using ethnicity, BMI and diabetes, some cell counts remained below five; violating the assumptions for a reliable output. Therefore, combined analysis was not possible using this raw dataset. However, stratifying the results according to ethnicity, table 3 shows clustering of significant risk factors, demonstrating the greatest number of risks in Pakistani mothers.

Discussion

This study found significant differences between Pakistani, Bangladeshi and White British ethnic groups and smoking behaviour (at booking), gestation age at first booking, parity, mothers BMI (at booking), diagnosis of diabetes, maternal age and infant birthweight. Additionally, the results show clustering of diverse risk factors of Pakistani, Bangladeshi and White British mothers. Specifically, more White British mothers smoked (21.5%) and booked into maternity services earlier (84.8%), were younger *and* older, were more likely to have parity one (59.4%) and delivered infants with a higher birthweight. Conversely, Pakistani mothers were less likely to book into maternity services before 12th week (79.9%), have a parity of two-four, have a lighter BMI (25.2%), be aged 21-30 years old, diagnosed with diabetes (49%) and deliver a lighter infant (after controlling for confounds) (adjusted mean 3118.1g). On the other hand, Bangladeshi mothers were more likely to use insulin (0.8%) and were diagnosed specifically with gestational diabetes (2.1%). Moreover, similar to Pakistani mothers, less Bangladeshi mothers also booked in maternity services before 12th week (80.1%), compared with White British women (84.4%). The results show that differential risk factors cluster according to maternal ethnicity, in addition to highlighting that in this cohort, Pakistani mothers have more risk factors than White British or Bangladeshi mothers.

Recently, Petherick and colleagues (2016) published their results from the longitudinal cohort Born in Bradford (BiB) research, demonstating diverse clusters of health behaviours between White British and Pakistani mothers during pregnancy. Although the aim of their paper was to identify differences in characteristics (including lifestyle factors and health behvaiours) between Pakistani and White British mothers, their results evidenced distinct patterning, dicerned by maternal ethinicty in Pakistani and White British mothers. For example, White British mothers were more likely to smoke than Pakistani mothers and mothers educated to lower levels of academic attainment were found to engage in less healthful health behaviours.

(Petherick et al, 2016). Similarly, West and collegues (2014), showed differences between Pakistani and White British mothers; White British mothers were more likely to smoke, drink alcohol, have hypertensive disorders in pregnancy. Whereas Pakistani mothers were identified to be older on first birth, have a lower BMI (at booking) and develop GDM. Similarly, using linked census and hopsital records, Bansal and collegues (2014) identified ethnic variation between White British mothers, who were more likely to smoke and Pakistani mothers who were more likely to be younger, delivery infants preterm and Bangladeshi mothers who delivered the lightest infants. However, with the exception of Bansal *et al*, (2014) small number of Bangladeshi mothers (N=49), the other studies have not included outcomes for Bangladeshi women. In addition, these papers did not seek to identify whether aggregated risk factors may exisit or how these were dispersed for particular ethnic groups.

This is the first study, to our knowledge that contributes to the sparse evidence base that considers Bangladeshi mothers' risk factors in a UK maternity setting. Additionally, this study examines how health behaviours and increased risk are similar and different in Pakistani, Bangladeshi and White British mothers, in addition demonstrating distinct clustering patterns in each ethnicity and demonstrate that in this cohort, Pakistani mothers had the highest number of individual risk factors. This is perhaps not surprising, given the high rates of poor birth outcomes compared with White British or Bangladeshi mothers (Office for National Statistics, 2016). Furthermore, the clustering of results from this study may indicate a trend toward certain birth outcomes for some ethnic groups, commensurate with certain adverse health behaviour. For instance, higher numbers of White British smoke, consequently may experience lower than non-smoker mothers' birthweight and 49% of this cohort who had diabetes were Pakistani, a known risk factor for congenital anomalies and stillbirth (Baker, Simpson, Lloyd, Bauman, & Singh, 2011). Taken together, this suggests that a 'one-size fits all' approach to antenatal care may need careful reconsideration with the introduction of targeted interventions according to ethnicity addressing specific risk factors (Garcia, Ali, Papadopoulos, & Randhawa, 2015). This study provides several implications for nursing practice; having an increased awareness of risk factors for women of childbearing age and using initiatives such as '*Making Every Contact Count'*, nurses and health care professionals should use contact opportunities with women of child bearing age to identify possible risk, develop interventions to change unhelpful health behaviour, but also consider tailoring messages and resources to address relevant risk factors evidenced in distinct ethnic groups (Garcia, Ali, Papadopoulos, & Randhawa, 2015b; NICE, 2007).

Limitations

As previously mentioned, this study used data from the Hospital CMiS system over 6 years (2008-2013) which included a large sample (N=15,211) of which there was a representative sample of Bangladeshi mothers (N=2057) (Sarensen et al., 1996). However, data input into CMiS is reliant on the midwife transferring information from paper records and is liable to encounter human error or differential classification, consequently outside the rigor of the researcher. For instance, the MCAR test (Little, 1988) showed systematic missing data, particularly with regard to maternal height and weight, suggesting that this data input was omitted rather than missed, for whatever reason. Additionally, there were some challenges experienced with the data extraction and the raw data were restricted to categorical variables, limiting inferential statistical analysis. The CMiS data also did not facilitate analysis considering mothers place of birth, or length of residency which is likely to have mediated the results in this study further.

Conclusion

This study demonstrates diverse clusters of risk factors in Pakistani, Bangladeshi and White British mothers and highlights important differences between Pakistani and Bangladeshi women, in addition to White British mothers health behaviour during pregnancy. These distinct risk factors may help explain the ethnic variance evidenced in birth outcomes between these ethnic groups and suggests that specific behaviour change and risk-reduction health messages need to be implemented prior to pregnancy and during maternity care in the UK.

Words 3120

Abbreviations

Adjusted standardised residuals	ASR
Analysis Co-Variance	ANCOVA
Body Mass Index	BMI
Ciconia Maternity information System	CMiS
Gestational diabetes	GDM

Ethics approval and consent to participate

Ethics approval was provided by University of Bedfordshire Institute for Health Research (IHRREC442, November 2014) and received approval from the Luton and Dunstable University Hospital Trust Research &Development department (LDH0539).

Consent to publish

Not applicable.

Availability of data and materials

No additional data is available

Competing interests

None to declare

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